

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (currently amended) An ink jet head, comprising a head body which is provided with a plurality of nozzles and a plurality of pressure chambers and actuators respectively corresponding to the nozzles, and a driver IC for outputting driving signals for driving the actuators, wherein:

the actuators are arranged on a surface of the head body in a plurality of columns so as to form a plurality of actuator columns;

signal input terminals of the actuators are arranged locally in a predetermined area in a central portion of the surface of the head body between inner actuator columns;

the driver IC is provided with signal output terminals arranged so as to respectively correspond to the signal input terminals of the actuators; and

the driver IC is mounted on the head body by being directly attached thereto by face down bonding so that the signal output terminals and the signal input terminals are connected to each other,

wherein the actuators of each outer actuator column and the signal input terminals thereof are connected to each other by signal lines passing between actuators of one of the central actuator columns.

2. (original) The ink jet head of claim 1, wherein:

each of the actuator columns extends in a direction perpendicular to a scanning direction; and

the signal input terminals of the actuators are arranged in a direction perpendicular to the scanning direction on the surface of the head body in a central portion thereof with respect to the scanning direction.

3. (currently amended) The ink jet head of claim 2, wherein:

the actuator columns include a first central actuator column and a second central actuator column adjacent to each other in a central portion of the head body with respect to the scanning direction, and one or more outer actuator column provided on an outer side of the central actuator columns with respect to the scanning direction;

the signal input terminals of the actuators are arranged between the first central actuator column and the second central actuator column; ~~and~~

~~the actuators of each outer actuator column and the signal input terminals thereof are connected to each other by signal lines passing between actuators of one of the central actuator columns.~~

4. (original) The ink jet head of claim 3,

wherein the actuators of each actuator column are arranged at regular intervals so as to be shifted from the actuators of any other actuator column in a direction perpendicular to the scanning direction.

5. (withdrawn) An ink jet head, comprising a head body which is provided with a plurality of nozzles and a plurality of pressure chambers and actuators respectively corresponding to the nozzles, and a driver IC for outputting driving signals for driving the actuators, wherein:

the actuators are arranged on a surface of the head body;

a signal input terminal of each actuator is provided on the surface of the head body and arranged near the actuator so as to be continuous with the actuator;

the driver IC is provided with signal output terminals provided so as to respectively correspond to the signal input terminals of the actuators; and

the driver IC is mounted on the head body by being directly attached thereto by face down bonding so that the signal output terminals and the signal input terminals are connected to each other.

6. (withdrawn) The ink jet head of claim 5, wherein:

the actuators form a plurality of actuator columns each including a plurality of actuators arranged at regular intervals in a direction perpendicular to the scanning direction; and

the actuators of each actuator column are arranged so as to be shifted from the actuators of any other actuator column in the direction perpendicular to the scanning direction.

7. (currently amended) The ink jet head of claim 4 or 6,

wherein the actuators are arranged in a staggered pattern.

8. (withdrawn) An ink jet head, comprising a head body which is provided with a plurality of nozzles and a plurality of pressure chambers and actuators respectively corresponding to the nozzles, and a driver IC for outputting driving signals for driving the actuators, wherein:

the driver IC is attached to the head body; and

at least a driver IC side portion of the head body is made of the same material as the driver IC.

9. (withdrawn) An ink jet head, comprising a head body which is provided with a plurality of nozzles and a plurality of pressure chambers and actuators respectively corresponding to the nozzles, and a driver IC for outputting driving signals for driving the actuators, wherein:

the driver IC is mounted on the head body by flip chip bonding; and

at least a driver IC side portion of the head body is made of the same material as the driver IC.

10. (withdrawn) The ink jet head of claim 9, wherein:

the head body includes a body part provided with a plurality of nozzles and a plurality of pressure chamber depressions respectively corresponding to the nozzles;

each actuator includes a vibration plate provided on a surface of the body part so as to cover the pressure chamber depressions to define pressure chambers, piezoelectric elements individually provided on the surface of the vibration plate so as to

respectively correspond to the pressure chambers, and separate electrodes provided on one side of the piezoelectric elements;

signal input terminals to be connected to signal output terminals of the driver IC are respectively connected to the separate electrodes of the actuators; and

at least a front side portion of the body part is made of the same material as the driver IC.

11. (withdrawn) The ink jet head of claim 9, wherein:

the head body includes a body part provided with a plurality of nozzles and a plurality of pressure chamber depressions respectively corresponding to the nozzles;

each actuator includes a vibration plate provided on a surface of the body part so as to cover the pressure chamber depressions to define pressure chambers, and piezoelectric elements individually provided on the surface of the vibration plate so as to respectively correspond to the pressure chambers, each piezoelectric element being sandwiched between a common electrode and a separate electrode;

signal input terminals for connecting the separate electrodes of the actuators respectively to signal output terminals of the driver IC are provided on the surface of the vibration plate; and

the vibration plate is made of the same material as the driver IC.

12. (withdrawn) The ink jet head of claim 10 or 11,

wherein an entirety of the body part is made of the same material as the driver IC.

13. (withdrawn) The ink jet head of claim 8 or 9,
wherein the driver IC is made of silicon.

14. (withdrawn) An ink jet head, comprising a head body which is provided with a plurality of nozzles and a plurality of pressure chambers and actuators respectively corresponding to the nozzles, and a driver IC for outputting driving signals for driving the actuators, wherein:

the driver IC is attached to the head body; and

at least a driver IC side portion of the head body is made of a material whose coefficient of linear expansion is substantially equal to that of the driver IC.

15. (withdrawn) An ink jet head, comprising a head body which is provided with a plurality of nozzles and a plurality of pressure chambers and actuators respectively corresponding to the nozzles, and a driver IC for outputting driving signals for driving the actuators, wherein:

the driver IC is mounted on the head body by flip chip bonding so that signal input terminals of the actuators and signal output terminals of the driver IC are connected to each other; and

at least a driver IC side portion of the head body is made of a material whose coefficient of linear expansion is substantially equal to that of the driver IC.

16. (withdrawn) The ink jet head of any one of claims 8, 9, 14 and 15,

wherein signal input terminals are arranged locally in a predetermined area.

17. (withdrawn) The ink jet head of claim 16, wherein:

a plurality of actuator columns are formed, each including a plurality of actuators arranged in a direction perpendicular to a scanning direction;

the actuators of each actuator column are arranged so as to be shifted from the actuators of any other actuator column in the direction perpendicular to the scanning direction; and

the signal input terminals of the actuators are arranged in the direction perpendicular to the scanning direction between the actuator columns in a central portion of a body part with respect to the scanning direction.

18. (withdrawn) The ink jet head of claim 9 or 15,

wherein a signal input terminal of each actuator is provided near the actuator.

19. (withdrawn) The ink jet head of claim 14 or 15,

wherein a difference between a coefficient of linear expansion of at least a driver IC side portion of the head body and that of the driver IC is $123 \times 10^{-7} [1/^{\circ}\text{C}]$ or less.

20. (withdrawn) the ink jet head of claim 14 or 15, wherein:

the head body is formed in a thin-plate-like generally rectangular solid shape;

the actuators are provided on a surface of the head body;

the driver IC is attached to a portion of the surface of the head body; and

a front surface side of the head body undergoes a compression shear force due to thermal deformation from the driver IC, thereby bending the head body into a concave shape.

21. (withdrawn) The ink jet head of any one of claims 8, 9, 14 and 15, wherein the ink jet head is a line type head.

22. (withdrawn) An ink jet type recording apparatus, comprising:
the ink jet head of any one of claims 1 to 21; and
movement means for relatively moving the ink jet head and a recording medium with respect to each other.